

Serial No.: 10/032,357

Confirmation No.: 4965

Filed: December 21, 2001

For: METHODS FOR PLANARIZATION OF GROUP VII METAL-CONTAINING SURFACES USING
OXIDIZING GASES

Amendments to the Claims

This listing of claims replaces all prior versions, and listings, of claims in the above-identified application:

Listing of Claims

1. **(Currently Amended)** A planarization method comprising:
 - positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
 - supplying ~~[[a]]~~an acidic planarization composition in proximity to the interface;
 - ~~[[adding]]~~feeding an oxidizing ~~[[agent to]]~~gas into the planarization composition ~~in the form of a gas~~; and
 - planarizing the Group VIII metal-containing surface;
 - wherein the oxidizing gas has a standard reduction potential of at least about 1.4 versus a standard hydrogen electrode at 25°C.
2. **(Original)** The method of claim 1 wherein the Group VIII metal-containing surface of the substrate comprises a Group VIII metal in elemental form or an alloy thereof.
3. **(Original)** The method of claim 2 wherein the Group VIII metal-containing surface comprises elemental platinum, rhodium, iridium, ruthenium, or a combination thereof.
4. **(Original)** The method of claim 3 wherein the Group VIII metal-containing surface comprises elemental platinum.

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5. **(Original)** The method of claim 1 wherein the Group VIII metal is present in an amount of about 10 atomic percent or more.
6. **(Original)** The method of claim 1 wherein the substrate is a semiconductor substrate or substrate assembly.
7. **(Original)** The method of claim 1 wherein the polishing surface comprises a polishing pad and the planarization composition comprises a plurality of abrasive particles.
8. **(Original)** The method of claim 1 wherein the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than about 9 Mohs.
9. **(Original)** The method of claim 8 wherein the plurality of abrasive particles comprise CeO_2 , Al_2O_3 , SiO_2 , and mixtures thereof.
10. **(Original)** The method of claim 1 which is carried out in one step.
11. **(Original)** The method of claim 1 wherein the oxidizing gas is selected from the group consisting of oxygen, ozone, air, chlorine, nitrous oxide, nitric oxide, sulfur trioxide, an interhalogen, and combinations thereof.
12. **(Original)** The method of claim 11 wherein the oxidizing gas is selected from the group consisting of oxygen, air, and combinations thereof.
13. **(Original)** The method of claim 12 wherein the oxidizing gas is oxygen.

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14. **(Original)** The method of claim 1 wherein planarizing is carried out using a fixed abrasive article.
15. **(Currently Amended)** A planarization method comprising:
positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
supplying ~~[[a]]~~an acidic planarization composition in proximity to the interface;
feeding an oxidizing gas into the planarization composition;
and
planarizing the Group VIII metal-containing surface;
wherein the ~~planarization composition comprises an~~ oxidizing gas is selected from the group consisting of oxygen, air, chlorine, nitrous oxide, nitric oxide, sulfur trioxide, an interhalogen, and combinations thereof;
wherein the polishing surface comprises a fixed abrasive article or a polishing pad; and
wherein when the polishing surface comprises ~~[[a]]~~the polishing pad the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than 9 Mohs.
16. **(Currently Amended)** A planarization method comprising:
positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
supplying ~~[[a]]~~an acidic planarization composition in proximity to the interface;
~~[[adding]]~~feeding an oxidizing ~~[[agent to]]~~gas into the planarization composition
in the form of a gas;

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and

planarizing the Group VIII metal-containing surface;

wherein the oxidizing gas has a standard reduction potential of at least about 1.4 versus a standard hydrogen electrode at 25°C, wherein the oxidizing gas is ~~[[added in]]~~fed into the composition in an amount of no greater than about 10% by weight.

17. **(Currently Amended)** A planarization method comprising:

providing a semiconductor substrate or substrate assembly including at least one region of a platinum-containing surface;

providing a polishing surface;

providing ~~[[a]]~~an acidic planarization composition at an interface between the at least one region of platinum-containing surface and the polishing surface; and

~~[[adding]]~~feeding an oxidizing ~~[[agent to]]~~gas into the planarization composition ~~in the form of a gas;~~

planarizing the at least one region of platinum-containing surface;

wherein the oxidizing gas has a standard reduction potential of at least about 1.4 versus a standard hydrogen electrode at 25°C.

18. **(Original)** The method of claim 17 wherein the platinum is present in an amount of about 10 atomic percent or more.

19. **(Original)** The method of claim 17 wherein the platinum-containing surface comprises elemental platinum.

20. **(Original)** The method of claim 17 wherein the planarization composition comprises a plurality of abrasive particles selected from the group consisting of CeO₂, Al₂O₃, SiO₂, and mixtures thereof.

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21. **(Original)** The method of claim 17 wherein the platinum-containing surface comprises a platinum alloy.
22. **(Original)** The method of claim 17 wherein the semiconductor substrate or substrate assembly is a silicon wafer.
23. **(Original)** The method of claim 17 wherein the oxidizing gas is selected from the group consisting of oxygen, nitrous oxide, air, or combinations thereof.
24. **(Original)** The method of claim 23 wherein the oxidizing gas is selected from the group consisting of oxygen, air, or combinations thereof.
25. **(Original)** The method of claim 24 wherein the oxidizing gas is selected from the group consisting of oxygen.
26. **(Currently Amended)** A planarization method for use in forming a capacitor or barrier layer:
 - providing a wafer having a patterned dielectric layer formed thereon and a Group VIII metal-containing layer formed over the patterned dielectric layer, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
 - positioning a first portion of a polishing surface for contact with the Group VIII metal-containing layer;
 - ~~adding an oxidizing agent to the planarization composition in the form of a gas;~~
 - providing ~~[[a]]~~an acidic planarization composition in proximity to the contact between the polishing surface and the Group VIII metal-containing layer;

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feeding an oxidizing gas into the planarization composition;

and

planarizing the Group VIII metal-containing layer;

wherein the oxidizing gas has a standard reduction potential of at least about 1.4
versus a standard hydrogen electrode at 25°C.

27. **(Currently Amended)** The method of claim 16 wherein the polishing surface comprises
a fixed abrasive article or a polishing pad; and

wherein when the polishing surface comprises ~~[[a]]the~~ polishing pad the
planarization composition comprises a plurality of abrasive particles having a hardness of no
greater than 9 Mohs.

28. **(Currently Amended)** The method of claim 17 wherein the polishing surface comprises
a fixed abrasive article or a polishing pad; and

wherein when the polishing surface comprises ~~[[a]]the~~ polishing pad the
planarization composition comprises a plurality of abrasive particles having a hardness of no
greater than 9 Mohs.

29. **(Currently Amended)** The method of claim 26 wherein the polishing surface comprises
a fixed abrasive article or a polishing pad; and

wherein when the polishing surface comprises ~~[[a]]the~~ polishing pad the
planarization composition comprises a plurality of abrasive particles having a hardness of no
greater than 9 Mohs.